(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) **EP 3 255 737 B1**

(12) **EUROPEAN PATENT SPECIFICATION**

(45) Date of publication and mention of the grant of the patent:
23.04.2025 Bulletin 2025/17

(21) Application number: **17173133.4**

(22) Date of filing: **26.05.2017**

(51) International Patent Classification (IPC):
H01R 13/629 *(2006.01)* ***H01R 13/533*** *(2006.01)*
H01R 13/627 *(2006.01)*

(52) Cooperative Patent Classification (CPC):
H01R 13/62977; H01R 13/6275; H01R 13/533; H01R 2201/26

(54) CONNECTOR AND CONNECTOR ASSEMBLY

STECKVERBINDER UND STECKVERBINDERANORDNUNG

CONNECTEUR ET ENSEMBLE DE CONNECTEUR

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR

(30) Priority: **07.06.2016 JP 2016113546**

(43) Date of publication of application:
13.12.2017 Bulletin 2017/50

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(56) References cited:
JP-A- 2009 230 898
US-A- 3 394 337
US-A1- 2005 221 647
US-A1- 2006 040 533
US-A1- 2008 102 683
US-A1- 2009 325 416
US-B1- 6 347 955
US-B1- 8 092 246
US-B2- 7 285 005

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Description

BACKGROUND OF THE INVENTION

Field of the Invention

[0001] The present invention relates to a connector and a connector assembly which have configurations to prevent looseness between housings.

Description of the Related Art

[0002] There is a case in which connectors are required to be arranged in such a location to which vibrations are conducted as one near an engine in an engine room of an automobile. In such case, if looseness occurs between housings, contact sections of the connectors may be rubbed with each other to be scraped, leading to contact failures. For this reason, a configuration to prevent looseness between the housings is required. A number of different approaches have been used to address this problem.

[0003] Here, in Japanese Patent Publication JP 2011-23201A, a configuration is proposed in which a spring member is arranged between respective housings to prevent looseness between the housings.

[0004] US 2009/0325416 discloses a connector assembly in which the female housing is provided with a metal latch member on its external surface, which extends through holes in the wall of the female housing to engage grooves formed on the external surface of the male housing member on mating.

[0005] US 2008/0102683 discloses a connector assembly comprising a female housing member comprising an integrally formed resilient locking device for engagement with corresponding ridges provided on the surface of the male housing member on mating.

[0006] US 2005/0221647 and US 2006/0040533 disclose connector assemblies, which include lever and cam arrangements to effect mating of the male and female housing parts of the assembly.

[0007] US 3394337 and US 8092246 disclose an electrical connector comprising rectangular first and second connector portions and a pair of retaining clips positioned along the short sides of the rectangular connector portions to secure the portions together. Each clip extends away from and beyond its respective connector portion. In US 8092246 the second housing includes a transversely extending flange portion including grooves adapted to receive the clips extending from the first housing. The grooves are spaced from the body of the second housing and the pins extend parallel to the second housing.

[0008] US 7285005 and US 6347955 disclose connector assemblies including a first rectangular connector body and a flange portion extending transversely of the mating direction. Each flange portion comprises grooves spaced away from and extending parallel to the short side of the connector body, which are configured to receive resilient pins or beams for securing the first connector body to a second connector body.

[0009] JP 2009230898 discloses a connector comprising an one-piece female housing for connection to a male housing. The female housing is provided with spring members, which are retained within the volume of the female housing and engage with a spring accommodating part provided on the male housing to facilitate integration of and reduce the forces required for disengagement of the male and female housings.

[0010] In the case of the above-described Japanese Patent Publication JP 2011-23201A, the spring member is provided to prevent looseness between the housings. However, in the case of the configuration proposed in the above-described Japanese Patent Publication JP 2011-23201A, the spring member is sandwiched between the respective housings to press the spring member in a mating direction so as to cause the spring member to be deformed elastically. For this reason, in the case of this configuration, a force required to cause the spring member to be deformed elastically is directly added to a force required for mating when the spring member is not provided, and thus, the mating force may become excessive. In addition, a locking mechanism strong enough to counter a restoring force of the spring member being deformed elastically is required.

SUMMARY OF THE INVENTION

[0011] The present invention has been made in view of the above circumstances to provide a connector and a connector assembly which have configurations to prevent looseness between housings while reducing a mating force compared to the configuration proposed in the above-described Japanese Patent Publication JP 2011-23201A.

[0012] A connector assembly according a first aspect of the present invention is provided according to claim 1. The connector assembly comprises first connector comprising a first housing comprising an outer housing , a mating section including an inner housing and a front housing the mating section forming an approximately rectangular shape having two long sides and two short sides when projected in a mating direction;

a second connector comprising a second housing configured to mate with the first housing via inner housing, the second housing comprising grooves;
the inner housing of the first housing being configured to move between a mating starting state and a complete mating state via a halfway mating state) thereby to mate with the second housing ; and
spring members fixed to the first housing and being configured to be inserted into grooves provided in the second housing being mated therewith in a mating direction to be deformed elastically in a direction intersecting the mating direction at the complete mating state;

characterized in that the spring members are press-fitted into the two long sides and the two short sides of the inner housing of the rectangular mating section, the spring members are exposed from the inner housing and protrude therefrom in a mating direction whereby the spring members are configured such that when the connector is in a mating starting state or a half-way mating state the spring members are maintained in a state before elastic deformation and when the connector is in a complete mating state the spring members are pushed by the wall of groove of the second housing to elastically deform at the time of mating thereby to prevent looseness between the housings and to reduce the mating force.

[0013] Accordingly, looseness between the housings is prevented while reducing the mating force.

[0014] Here, in the connector assembly according to the present invention, it is preferable that the connector assembly further includes: a cam member that receives a cam pin provided in the second housing to be slid in a direction intersecting the mating direction and draw in the cam pin so as to cause the second housing to be mated; and an operation lever that causes the cam member to slide by a rotating operation.

[0015] When such a cam member and such an operation lever are provided, it is possible to reduce a force required for mating of an operator.

[0016] In addition, in the connector assembly of the present invention, the mating section has an approximately rectangular shape when being projected in the mating direction, and the spring member is provided on each of a short side and a long side of the approximately rectangular shape of the mating section.

[0017] When a looseness preventing configuration including the above-described spring member and the above-described groove is provided in each of the above-described short side and the long side, looseness with respect to vibrations in plural directions is prevented.

[0018] According to the above present invention, it is possible to prevent looseness between the housings while repressing an increase of the mating force.

BRIEF DESCRIPTION OF THE DRAWINGS

[0019]

FIG. 1 is an exploded perspective view of a first connector;

FIG. 2 is a perspective view illustrating a state in which the first connector illustrated in the exploded perspective view in FIG. 1 is assembled;

FIG. 3 is a perspective view illustrating a remaining assembly in which a wire cover, an operation lever and an outer housing are removed from the first connector in the assembled state illustrated in FIG. 2;

FIG. 4 illustrates a perspective view (Part A) and a plan view (Part B) of the cam member;

FIG. 5 illustrates a side view (Part A) and a plan view (Part B) of the first connector;

FIG. 6 illustrates sectional views along arrows A-A illustrated in FIG. 5 of the first connector;

FIG. 7 illustrates sectional views along arrows B-B illustrated in FIG. 5 of the first connector;

FIG. 8 illustrates schematic diagrams illustrating states in which a boss of the cam member is caught by a narrowed section;

FIG. 9 illustrates side views of a connector assembly including the first connector and a second connector (Part A) and a sectional view along arrows C-C illustrated in Part A of FIG. 9 (Part B);

FIG. 10 illustrates sectional views along arrows D-D illustrated in FIG. 9;

FIG. 11 illustrates sectional views along arrows E-E illustrated in FIG. 9 (Part A-1, Part A-3) and partially enlarged views (Part B-1, Part B-2, Part B-3); and

FIG. 12 is sectional views along arrows C-C illustrated in FIG. 9 (Part A-1, Part A-3) and partially enlarged views (Part B-1, Part B-2, Part B-3).

DETAILED DESCRIPTION

[0020] Exemplary embodiments of the present invention will be explained in the following.

[0021] FIG. 1 is an exploded perspective view of a first connector.

[0022] In here, the connector illustrated by the exploded perspective view in FIG. 1 is referred to as a first connector 1, and a mating connector to mate with the first connector is referred to as a second connector 2 (see FIG. 9). A connector assembly as an embodiment is configured with these first connector 1 and second connector 2.

[0023] A large number of terminals, each of which is connected to one end of an electrical wire, are inserted into the first connector 1 illustrated in the exploded perspective view in the FIG. 1. However, illustrations of the electrical wires and the like are omitted in here.

[0024] In addition, the first connector 1 illustrated in FIG. 1 includes an operation lever 10. The operation lever 10 is provided with pinon gears 11. The operation lever 10 is a member to cause cam members 40, which will be described later, to slide by a rotating operation of an operator.

[0025] In addition, the first connector 1 includes a wire cover 20. This wire cover 20 includes an opening 21 through which the not-illustrated large number of wires, to ends of which the terminals are connected, pass.

[0026] In addition, the first connector 1 includes a housing configured with three parts; an outer housing 30; an inner housing 70; and a front housing 100. The housing configured with the three parts of the outer housing 30, the inner housing 70 and the front housing 100 corresponds to an example of the first housing according to the present invention.

[0027] The outer housing 30 is provided with two grooves communicating with openings which open in side walls thereof, and the two cam members 40 having plate shapes are inserted into the grooves, respectively. These cam members 40 are provided with racks 41. The racks 41 engage with the pinion gears 11 of the operation lever 10, and the cam members 40 are slid in a lateral direction indicated with arrows X-X' in FIG. 1 by the rotating operation of the operation lever 10.

[0028] In addition, the first connector 1 includes two seal members 50, 90. One seal member 50 of them is arranged inside an opening 71 of the inner housing 70. The seal member 50 closely contacts a surrounding wall of the opening 71, and also surrounds the not-illustrated electrical wires to closely contact the respective electrical wires, playing a role in forming a sealing structure between them.

[0029] In addition, the other seal member 90 surrounds an outer circumference of the inner housing 70, and plays a role in sealing between the inner housing 70 and the second connector 2 (see FIG. 9, FIG. 11, FIG. 12) being mated therewith.

[0030] In addition, the first connector 1 includes a retainer 80. This retainer 80 is inserted in a direction of arrows Y into a groove 72 which opens in a lateral direction of the inner housing 70. The retainer 80 plays a role in securely positioning and fixing the not-illustrated terminals in the inner housing 70.

[0031] Further, the first connector 1 includes six spring members 60. Tail sections of those spring members 60 are press-fitted into the inner housing 70, and the spring members 60 protrude in a mating direction indicated by arrow Z. A mating section of the first connector 1, which mating section includes the inner housing 70 and so on, has an approximately rectangular shape when being projected in the mating direction (the direction of arrow Z). Two pieces of the six spring members 60 are press-fitted into two short or relatively shorter sides of the approximately rectangular shape, one piece into each short side. In addition, the remaining four pieces of the six spring members 60 are press-fitted into the two long or relatively longer sides of the approximately rectangular shape, two pieces into each long side. The two spring members 60 which are press-fitted into each long side are each press-fitted into a position near a respective short side. Operations of these spring members 60 will be explained later.

[0032] FIG. 2 is a perspective view illustrating a state in which the first connector illustrated with the exploded perspective view in FIG. 1 is assembled.

[0033] A mating opening 32 which opens in the mating direction (the direction indicated by arrow Z) is formed in the outer housing 30. The inner housing 70 (see FIG. 1) and the front housing 100 are arranged in the mating opening 32. The front housing 100 forms a circumferential space for mating with the second connector between the outer housing 30 and the front housing 100, and protrudes from the mating opening 32.

[0034] Although the second connector 2 is not illustrated in this FIG. 2, the operation lever 10 is rotated to a state of complete mating of the second connector 2. When the operation lever 10 is in the position illustrated in FIG. 2, the cam members 40 are in a state of completely being inserted into the grooves communicating with the opening 31.

[0035] FIG. 3 is a perspective view illustrating a remaining assembly in which the wire cover, the operation lever and the outer housing are removed from the first connector in the assembled state illustrated in FIG. 2.

[0036] The inner housing 70, the seal member 90, the front housing 100 and the spring members 60 appear in FIG. 3. The spring members 60 are press-fitted into the inner housing 70, and protrude from the inner housing 70 in the mating direction (the direction of arrow Z). Spring members 60 which are press-fitted into left and right short sides (one piece each side) and two spring members 60 which are press-fitted into each of the long sides, each of which is positioned near a respective one of the short sides, are illustrated. Two spring members 60 are also similarly press-fitted into the long side opposite to the long side illustrated in FIG. 3.

[0037] In addition, a long groove 74, sandwiched between two rails 73, and extending along the long side is formed in the inner housing 70. Two rails 73 and a long groove 74 are also formed similarly in a long side on the opposite side which long side does not appear in FIG. 3. Bosses 42 (see FIG. 4) of the cam member 40 enter this long groove 74. The cam member 40 is slid in the lateral direction indicated by arrows X-X' while being guided by the long groove 74 in a state in which the bosses 42 enter the long groove 74. In the long groove 74, a narrowed section 741, in which a groove width is narrowed is formed at each of two locations. Operations of the narrowed sections 741 will be described later.

[0038] FIG. 4 illustrates a perspective view (Part A) and a plan view (Part B) of a cam member.

[0039] The two cam members 40 are provided in the first connector 1 as illustrated in FIG. 1. The cam member 40 illustrated in FIG. 4 is one cam member 40 of those two cam members 40. The other cam member 40 has a mirror image with respect to the cam member 40 illustrated in FIG. 4.

[0040] A rack 41 is provided in this cam member 40. This rack 41 plays a role in engaging with the pinion gear 11 of the operation lever 10 illustrated in FIG. 1 to cause the cam member 40 to slide in the lateral direction (the direction of arrows X-X') according to the rotating operation of the operation lever 10.

[0041] In addition, six bosses 42 aligned laterally are provided on this cam member 40. These bosses 42 enter the long groove 74 illustrated in FIG. 3. The cam member 40 is slid while being guided by the long groove 74. This cam member 40 plays a role in drawing in the second connector 2 toward complete mating in such a manner as explained in the following. The cam member 40 receives a force from the second connector 2 when drawing in the

second connector 2. A reason why the six bosses 42 are formed on this cam member 40 is for providing strength enough to catch the force to be received from the mating second connector 2.

[0042] Further, two cam grooves 43 are formed in this cam member 40. Mating protrusions 202 (see FIG. 10) provided on a housing 201 (see FIG. 11, FIG. 12) of the second connector 2 to mate with the first connector 1 enter these cam grooves 43. Each of the mating protrusions 202 corresponds to the cam pin according to the present invention.

[0043] When the cam member 40 is slid by the rotating operation of the operation lever 10, the mating protrusions 202 are drawn into the cam grooves 43. Thus, the second connector 2 is drawn into the first connector 1 toward the complete mating state. When the mating protrusions 202 are drawn into the deepest positions or parts of the cam grooves 43, mating of the first connector 1 and the second connector 2 is completed. In other words, the first connector 1 and the second connector 2 reach a state of completely mating with each other.

[0044] In the cam grooves 43 provided in the cam member 40, narrowed sections 431 in each of which a groove width is narrowed are provided in the deepest portions thereof. Operations of the narrowed sections 431 will be described later.

[0045] FIG. 5 illustrates a side view (Part A) and a plan view (Part B) of the first connector.

[0046] In this FIG. 5, the operation lever 10 is in a posture of standing up. A state of the first connector 1 when the operation lever 10 is in the posture of standing up is referred to as "a mating starting state." On the other hand, a state of the first connector 1 when the operation lever 10 is in the posture of being lowered illustrated in FIG. 2 is referred to as "a complete mating state." A state of the connector 1 when the operation lever 10 is operated and rotated halfway from the position of standing up as illustrated in FIG. 5 toward the position of being lowered as illustrated in FIG. 2 is referred to as "a halfway mating state."

[0047] FIG. 6 illustrates sectional views along arrows A-A illustrated in FIG. 5 of the first connector.

[0048] FIG. 5 illustrates the first connector 1 in "the mating starting state." Accordingly, to be more precise, of the three sectional views in Part (A), Part (B) and Part (C) of FIG. 6, the sectional view of "the mating starting state" illustrated in Part (A) of FIG. 6 corresponds to the sectional view along arrows A-A illustrated in FIG. 5. Part (B) and Part (C) of FIG. 6 illustrate the sectional views of "the halfway mating state" and "the complete mating state" at the same location as arrows A-A illustrated in FIG. 5, respectively. This similarly applies to FIG. 7, FIG. 10 and so on which will be described later. In the following, shortened expressions like, for example, "FIG. 6 is the sectional view along arrows A-A illustrated in FIG. 5", will be used without previous notice.

[0049] As illustrated in Part (A) to Part (C) of FIG. 6, the pinion gear 11 of the operation lever 10 continuously engages with the rack 41 of the cam member 40. And the cam member 40 is slid laterally (in the direction of arrow X') as the state proceeds from "the mating starting state" illustrated in Part (A) of FIG. 6 to "the halfway mating state" illustrated Part (B) of FIG. 6 and further to "the complete mating state" illustrated in Part (C) of FIG. 6.

[0050] When the cam member 40 is in "the mating starting state" illustrated in FIG. 6, the cam member 40 is at a position to receive the mating protrusions 202 of the second connector 2. The cam member 40 draws in the mating protrusions 202 in the direction of arrow Z' as the state proceeds to "the halfway mating state" and further to "the complete mating state".

[0051] FIG. 7 illustrates sectional views along arrows B-B illustrated in FIG. 5 of the first connector 1. Here, similarly to Part (A), Part (B) and Part (C) of FIG. 6, Part (A), Part (B) and Part (C) of FIG. 7 illustrate "the mating starting state", "the halfway mating state" and "the complete mating state", respectively.

[0052] The six bosses 42 provided on the cam member 40 are illustrated in this FIG. 7. These six bosses 42 move in the direction of arrow X' as the state proceeds from "the mating starting state" to "the halfway mating state" and further to "the complete mating state." In "the complete mating state" illustrated in Part (C) of FIG. 7, two bosses 42a of both ends of those six bosses 42 reach a state of being caught by the narrowed sections 741 of the long groove 74 provided in the inner housing 70.

[0053] FIG. 8 illustrates schematic diagrams illustrating states in which the boss of the cam member is caught by the narrowed section. Here, a state in which the boss 42a is at a position immediately before being caught by the narrowed section 741 is illustrated in Part (A) of FIG. 8. In addition, a state in which the boss 42a is caught by the narrowed section 741 is illustrated in Part (B) of FIG. 8.

[0054] The cam member 40 is slid in the direction of arrow X' up to "the complete mating state." Then, as illustrated in Part (B) of FIG. 8, the two bosses 42a of both the ends of the six bosses 42 provided on the cam member 40 reach the state of being caught by the narrowed sections 741 of the long groove 74 provided in the inner housing 70. Groove widths of the narrowed sections 741 are made to be ones into which the bosses 42s are lightly press-fitted. When the bosses 42a are press-fitted into the narrowed sections 741, the cam members 40 are united with the housing (the inner housing 70), and a state in which looseness between them is prevented is obtained.

[0055] FIG. 9 illustrates side views of a connector assembly including the first connector and the second connector (Part A) and a sectional view along arrows C-C illustrated in Part A of FIG. 9 (Part B). In this FIG. 9, the first connector 1 is in "the mating starting state" as same as being in FIG. 5, and the first connector 1 and the second connector 2 are in a temporary mating state.

[0056] FIG. 10 illustrates sectional views along arrows D-D illustrated in FIG. 9. Here, Part (A), Part (B) and Part (C) of FIG. 10 illustrate sectional views of "the mating starting state", "the halfway mating state" and "the complete mating state", respectively.

[0057] The mating protrusions 202 provided on the housing 201 (see FIG. 11, FIG. 12) of the second connector 2 are illustrated in this FIG. 10.

[0058] When the first connector 1 is in "the mating starting state" illustrated in the Part (A) of FIG. 10, the second connector 2 is inserted to the first connector 1 up to a temporary mating state. Then, as illustrated in Part (A) of FIG. 10, the mating protrusions 202 of the second connector 2 enter entrance sections of the cam grooves 43 of the cam member 40. Subsequently, the operation lever starts being lowered, and the state is proceeding to "the halfway mating state" (Part (B) of FIG. 10), and further to "the complete mating state" (Part (C) of FIG. 10). At this moment, the cam member 40 is slid in the direction of arrow X' to draw in the mating protrusions 202 in the direction of arrow Z'. And when the mating protrusions 202 are drawn in up to the deepest positions of the cam grooves 43 illustrated in Part (C) of FIG. 10, the second connector 2 reaches the state of completely mating with the connector 1.

[0059] The cam grooves 43 include the narrowed sections 431 in which the widths of the grooves 43 are narrowed at the locations where the mating protrusions 202 are positioned in "the complete mating state." The groove widths in the narrowed sections 431 are wide to the extent that the mating protrusions 202 are lightly press-fitted into the narrowed sections 431. Accordingly, in "the complete mating state" illustrated in Part (C) of FIG. 10, the housing 201 of the second connector 2 is united with this cam member 40, and the state in which looseness between them is prevented is obtained. In "the complete mating state", as explained with reference to FIG. 7 and FIG. 8, the bosses 42a of the both ends of the cam member 40 are caught by the narrowed sections 741 of the long groove 74 of the housing (the inner housing 70) of the first connector 1. As described, in "the complete mating state", with the mating protrusions 202 being caught by the narrowed sections 431 and the bosses 42a being caught by the narrowed sections 741, the first connector 1 and the second connector 2 are united with each other via the cam members 40, and thus looseness between them is prevented. The looseness prevention configuration via the cam members 40 is specifically effective for looseness prevention in the mating direction (the direction of arrow Z' or the direction of arrow Z illustrated in FIG. 1).

[0060] FIG. 11 illustrates sectional views along arrows E-E illustrated in FIG. 9 (Part A-1, Part A-3) and partially enlarged views (Part B-1, Part B-2, Part B-3). Here, Part (A-1) and Part (A-3) of the FIG. 11 illustrate sectional views of "the mating starting state" and "the complete mating state", respectively. To avoid the complication of illustrations, illustrations of a sectional view in "the halfway mating state" are omitted in here.

[0061] Part (B-1) and Part (B-3) of FIG. 11 are enlarged views of portions indicated by circles R illustrated in Part (A-1) and Part (A-3) of FIG. 11, respectively. In addition, Part (B-2) of FIG. 11 is an enlarged view of a corresponding portion in "the halfway mating state."

[0062] Spring members 60 are illustrated in this FIG. 11. The spring members 60 illustrated in this FIG. 11 are the spring members 60 arranged on the long sides of the mating section which forms the approximately rectangular shape when being projected in the mating direction. These spring members 60 are firmly press-fitted into the inner housing 70. And those spring members 60 are exposed from the inner housing 70, and protrude toward the second connector 2. On the other hand, grooves 203 which allow the spring members 60 to enter the grooves 203 are provided in the housing 201 of the second connector 2. These spring members 60 are received into the grooves 203 of the housing 201 of the second connector 2 being mated therewithin the mating direction. Then, when the spring members 60 are completely inserted into the grooves 203, the spring members 60 elastically deform in a direction that intersects the mating direction (a horizontal direction of FIG. 11). However in B1 and B2 the spring members 60 are illustrated in a state prior to elastic deformation. In B3 (FIG. 11) the spring member 60 is illustrated in a state in which spring member 60 engages a wall surface of the groove 203. However, in practice, the spring member 60 is pushed by the wall surface of the groove 203 to elastically deform.

[0063] FIG. 12 illustrates sectional views along arrows C-C illustrated in FIG. 9 (Part A-1, Part A-3) and partially enlarged views (Part B-1, Part B-2, Part B-3). Here, similarly to Part (A-1) and Part (A-3) of the FIG. 11, Part (A-1) and Part (A-3) of the FIG. 12 illustrate sectional views of "the mating starting state" and "the complete mating state", respectively. Illustrations of a sectional view in "the halfway mating state" are omitted.

[0064] Part (B-1) and Part (B-3) of FIG. 12 are enlarged views of portions indicated by circles R illustrated in Part (A-1) and Part (A-3) of FIG. 12, respectively. In addition, Part (B-2) of FIG. 12 is an enlarged view of a corresponding portion in "the halfway mating state."

[0065] As with FIG. 11, FIG. 12 also illustrates spring members 60. The spring members 60 illustrated in this FIG. 12 are the spring members 60 arranged on the short sides of the mating section which forms the approximately rectangular shape when being projected in the mating direction. These spring members 60 are firmly press-fitted into the inner housing 70. And those spring members 60 are exposed from the inner housing 70 and protrude toward the second connector 2. On the other hand, the housing 201 of the second connector is provided with grooves 203 for receiving spring members 60. These spring members 60 enter the grooves 203 of the housing 201 in the second connector 2 being mated therewith in the mating direction. Whereas, upon being fully inserted into the grooves 203, the spring members

60 are elastically deformed in a direction intersecting the mating direction (a horizontal direction of the FIG. 12). Incidentally, here in B1 and B2, similarly to FIG. 11, the spring members 60 are illustrated while maintaining a state before being elastically deformed. For this reason, in Part (B-3) of FIG. 12, the spring member 60 is illustrated in a state in which the spring member 60 engages a wall surface of the groove 203. However, in practice, the spring member 60 would be pushed by the wall surface of the groove 203 and elastically deform.

[0066] These spring members 60 are provided by six pieces totally as illustrated in FIG. 1. These spring members 60 are press-fitted into the housing (the inner housing 70) of the first connector 1, and the spring members 60 enter the grooves 203 of the housing 201 of the second connector 2 in the state of being elastically deformed at the time of mating. In the present embodiments, by the spring members 60 and the grooves 203, looseness between the first connector 1 and the second connector 2 is prevented. The looseness prevention configuration by the spring members 60 and the grooves 203 are effective mainly for preventing looseness in a direction on a plane intersecting the mating direction.

[0067] Incidentally, the six spring members 60 are provided in the present embodiment, and however, the number of the spring members 60 is not limited to six and the spring members 60 may be provided as many as effective enough only for preventing looseness.

[0068] In addition, the spring members 60 are provided on each of the long sides and the short sides of the mating section in the present embodiment. In an example not forming part of the current invention, in a case in which a direction of vibration is limited, the spring members 60 may be provided, for example, only on the short sides or only on the long sides for preventing looseness in a direction according to the direction of vibration.

[0069] Further, in the present embodiment, the spring members 60 are arranged behind the seal member 90 along the mating direction Z, and however, the spring members 60 may be arranged at a position ahead of the seal member 90 (a position of F in FIG. 11).

Claims

1. A connector assembly (1,2) comprising:

a first connector (1) comprising a first housing comprising an outer housing (30), a mating section including an inner housing (70) and a front housing (100) the mating section forming an approximately rectangular shape having two long sides and two short sides when projected in a mating direction (z);
a second connector(2)comprising a second housing (201) configured to mate with the first housing (30) via inner housing (70), the second housing (201) comprising grooves (203);the inner housing (70) of the first housing (100) being configured to move between a mating starting state (A1, B1) and a complete mating state (A3, B3) via a halfway mating state (B2)thereby to mate with the second housing (201); and
spring members (60) fixed to the first housing (30,70,100) and being configured to be inserted into the grooves (203) provided in the second housing (201) being mated therewith in a mating direction (Z) to be deformed elastically in a direction intersecting the mating direction (z) at the complete mating state (A3, B3);
characterized in that the spring members (60) are press-fitted into the two long sides and the two short sides of the inner housing (70) of the rectangular mating section, the spring members (60) are exposed from the inner housing (70) and protrude therefrom in a mating direction (z) whereby the spring members (60) are configured such that when the connector (1) is in a mating starting state (A1, B1) or a half-way mating state (B2) the spring members (60) are maintained in a state before elastic deformation and when the connector is in a complete mating state (A3) the spring members (60) are pushed by the wall of the groove (203) of the second housing (201) to elastically deform at the time of mating thereby to prevent looseness between the housings and to reduce the mating force.

2. The connector according to claim 1, wherein the spring members (60) comprise tail sections, which tail sections are press-fitted into the sides of the inner housing (70).

3. The connector (1) according to claim 1, further comprising:

a cam member (40) that is configured to receive a cam pin (202) provided in the second housing (201) to be slid in a direction intersecting the mating direction and draw in the cam pin (202) so as to cause the second housing (201) to be mated; and
an operation lever (10) that causes the cam member (40) to slide by a rotating operation.

4. The connector according to claim 1, wherein each of the relatively longer sides is provided with two spring members (60) and each of the relatively shorter sides is provided with one spring member (60).

5. A connector assembly (1,2) according to claim 4, wherein each of the spring members (60) on the longer sides is positioned nearer their respective shorter side of the housing (70).

Patentansprüche

1. Verbinderanordnung (1, 2), die Folgendes umfasst:

einen ersten Verbinder (1), umfassend ein erstes Gehäuse, das ein Außengehäuse (30) umfasst, einen Verpaarungsabschnitt mit einem Innengehäuse (70) und einem Frontgehäuse (100), wobei der Verpaarungsabschnitt eine etwa rechteckige Form mit zwei langen Seiten und zwei kurzen Seiten bildet, wenn er in einer Verpaarungsrichtung (z) projiziert wird;
einen zweiten Verbinder (2), umfassend ein zweites Gehäuse (201), das zum Verpaaren mit dem ersten Gehäuse (30) über das innere Gehäuse (70) konfiguriert ist, wobei das zweite Gehäuse (201) Nuten (203) umfasst; wobei das innere Gehäuse (70) des ersten Gehäuses (100) zum Bewegen zwischen einem Verpaarungsanfangszustand (A1, B1) und einem Verpaarungsendzustand (A3, B3) über einen Verpaarungsmittenzustand (B2) konfiguriert ist, um dadurch mit dem zweiten Gehäuse (201) verpaart zu werden; und
Federelemente (60), die am ersten Gehäuse (30, 70, 100) befestigt und zum Einsetzen in die im zweiten Gehäuse (201) vorgesehenen Nuten (203) konfiguriert sind, das damit in einer Verpaarungsrichtung (Z) verpaart wird, um in einer die Verpaarungsrichtung (z) schneidenden Richtung im Verpaarungsendzustand (A3, B3) elastisch verformt zu werden;
dadurch gekennzeichnet, dass die Federelemente (60) in die zwei langen Seiten und die zwei kurzen Seiten des Innengehäuses (70) des rechteckigen Verpaarungsabschnitts eingepresst sind, wobei die Federelemente (60) aus dem Innengehäuse (70) exponiert sind und in einer Verpaarungsrichtung (z) davon vorstehen, wobei die Federelemente (60) so konfiguriert sind, dass, wenn der Verbinder (1) in einem Verpaarungsanfangszustand (A1, B1) oder einem Verpaarungsmittenzustand (B2) ist, die Federelemente (60) in einem Zustand vor der elastischen Verformung gehalten werden, und die Federelemente (60) durch die Wand der Nut (203) des zweiten Gehäuses (201) gedrückt werden, um sich zum Zeitpunkt des Verpaarens elastisch zu verformen, wodurch Spiel zwischen den Gehäusen verhindert und die Verpaarungskraft verringert wird, wenn der Verbinder in einem Verpaarungsendzustand (A3) ist.

2. Verbinder nach Anspruch 1, wobei die Federelemente (60) Endabschnitte aufweisen, die in die Seiten des Innengehäuses (70) eingepresst sind.

3. Verbinder (1) nach Anspruch 1, der ferner Folgendes umfasst:

ein Nockenelement (40), konfiguriert zum Aufnehmen eines im zweiten Gehäuse (201) vorgesehenen Nockenstifts (202), um in einer die Paarungsrichtung schneidenden Richtung verschoben zu werden, und zum Einziehen des Nockenstifts (202), um das Verpaaren des zweiten Gehäuses (201) zu bewirken; und
einen Betätigungshebel (10), der bewirkt, dass das Nockenelement (40) durch eine Drehbetätigung gleitet.

4. Verbinder nach Anspruch 1, wobei jede der relativ längeren Seiten mit zwei Federelementen (60) versehen ist und jede der relativ kürzeren Seiten mit einem Federelement (60) versehen ist.

5. Verbinderanordnung (1, 2) nach Anspruch 4, wobei jedes der Federelemente (60) an den längeren Seiten näher an ihrer jeweiligen kürzeren Seite des Gehäuses (70) positioniert ist.

Revendications

1. Ensemble connecteur (1, 2) comprenant :

un premier connecteur (1) comprenant un premier logement comprenant un logement externe (30), une section d'accouplement incluant un logement interne (70) et un logement frontal (100), la section d'accouplement formant une forme approximativement rectangulaire ayant deux côtés et deux côtés courts lorsqu'ils sont en saillie dans une direction d'accouplement (z) ;
un deuxième connecteur (2) comprenant un deuxième logement (201) configuré pour s'accoupler avec le premier logement (30) via le logement interne (70), le deuxième logement (201) comprenant des rainures (203) ; le logement interne (70) du premier logement (100) étant configuré pour se déplacer entre un état de commencement d'accouplement (A1, B1) et un état d'accouplement complet (A3, B3) via un état d'accouplement médian (B2) pour s'accoupler ainsi avec le deuxième logement (201) ; et des éléments à ressort (60) fixés sur le premier logement (30, 70, 100) et étant configurés pour être insérés dans les rainures (203) ménagées dans le deuxième logement (201) en cours d'accouplement avec celui-ci dans une direction d'accouplement (Z) pour être déformés élastiquement dans une direction en intersection avec la direction d'accouplement (z) à l'état d'accouplement complet (A3, B3) ;
caractérisé en ce que les éléments à ressort

(60) sont ajustés par pression dans les deux côtés longs et les deux côtés courts du logement interne (70) de la section d'accouplement rectangulaire, les éléments à ressort (60) étant exposés à partir du logement interne (70) et faisant saillie de celui-ci dans une direction d'accouplement (z), en vertu de quoi les éléments à ressort (60) sont configurés de telle sorte que, lorsque le connecteur (1) est dans un état de commencement d'accouplement (A1, B1) ou un état d'accouplement médian (B2), les éléments à ressort (60) sont maintenus dans un état qui précède la déformation élastique et, lorsque le connecteur est dans un état d'accouplement complet (A3), les éléments à ressort (60) sont poussés par la paroi de la rainure (203) du deuxième logement (201) afin de se déformer élastiquement au moment de l'accouplement, ce qui évite ainsi un relâchement entre les logements et réduit la force d'accouplement.

2. Connecteur selon la revendication 1, dans lequel les éléments à ressort (60) comprennent des sections d'extrémité, ces sections d'extrémité étant ajustées par pression dans les côtés du logement interne (70).

3. Connecteur (1) selon la revendication 1, comprenant en outre :

un élément à came (40) qui est configuré pour recevoir une broche de came (202) prévue dans le deuxième logement (201) pour être glissée dans une direction en intersection avec la direction d'accouplement, et pour rentrer la broche de came (202) de sorte à amener le deuxième logement (201) à être accouplé ; et
un levier d'actionnement (10) qui amène l'élément à came (40) à coulisser suivant une opération de rotation.

4. Connecteur selon la revendication 1, dans lequel chacun des côtés relativement longs est pourvu de deux éléments à ressort (60), et chacun des côtés relativement courts est pourvu d'un seul élément à ressort (60).

5. Ensemble connecteur (1, 2) selon la revendication 4, dans lequel chacun des éléments à ressort (60) sur les côtés longs est positionné plus près de son côté plus court respectif du logement (70).

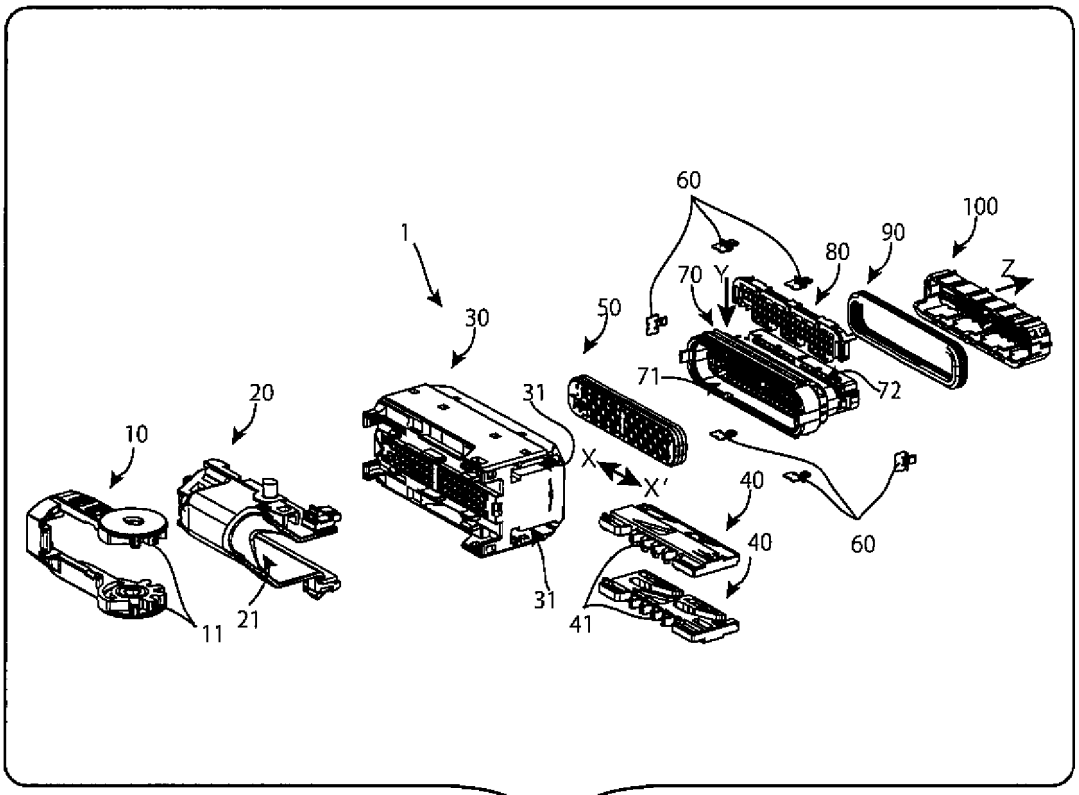

FIG.1

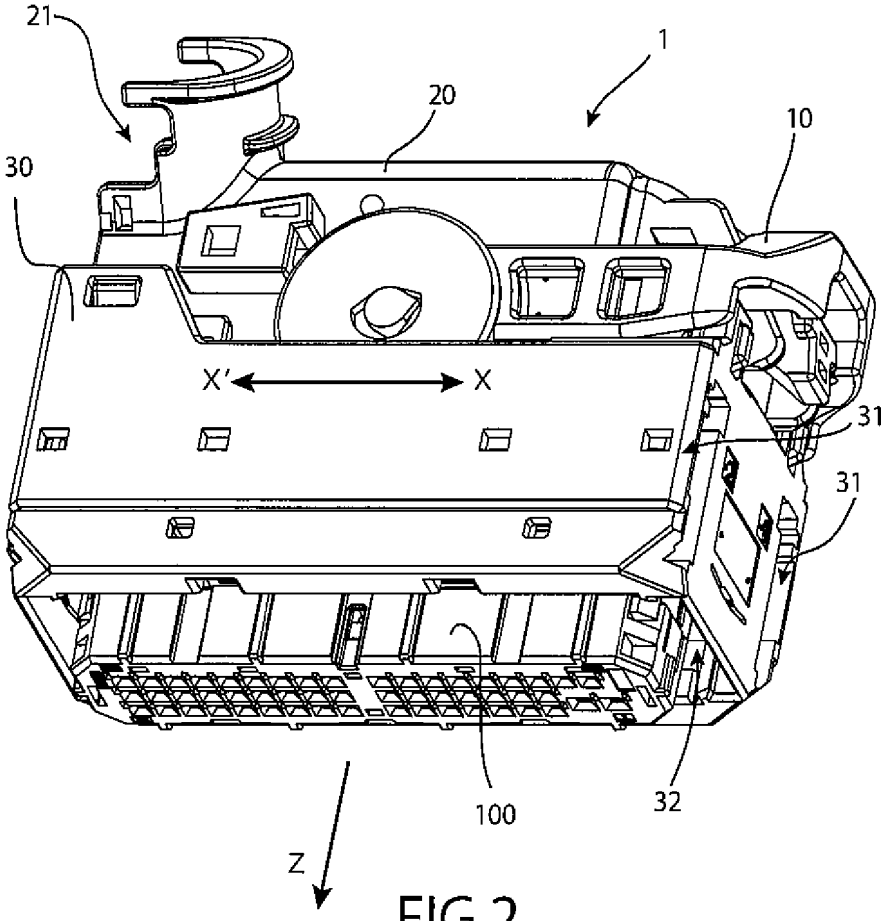

FIG.2

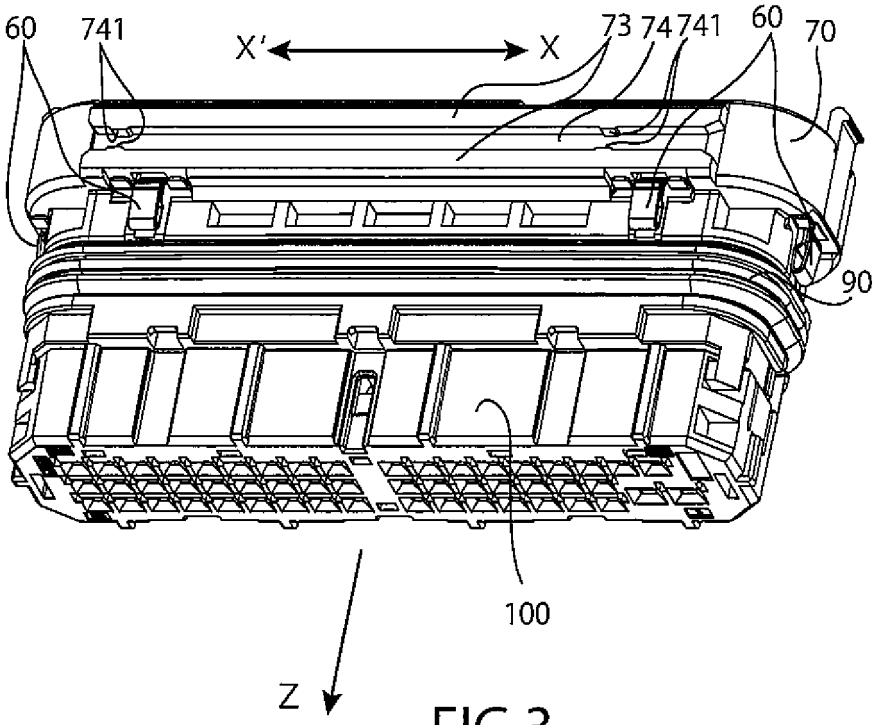

FIG.3

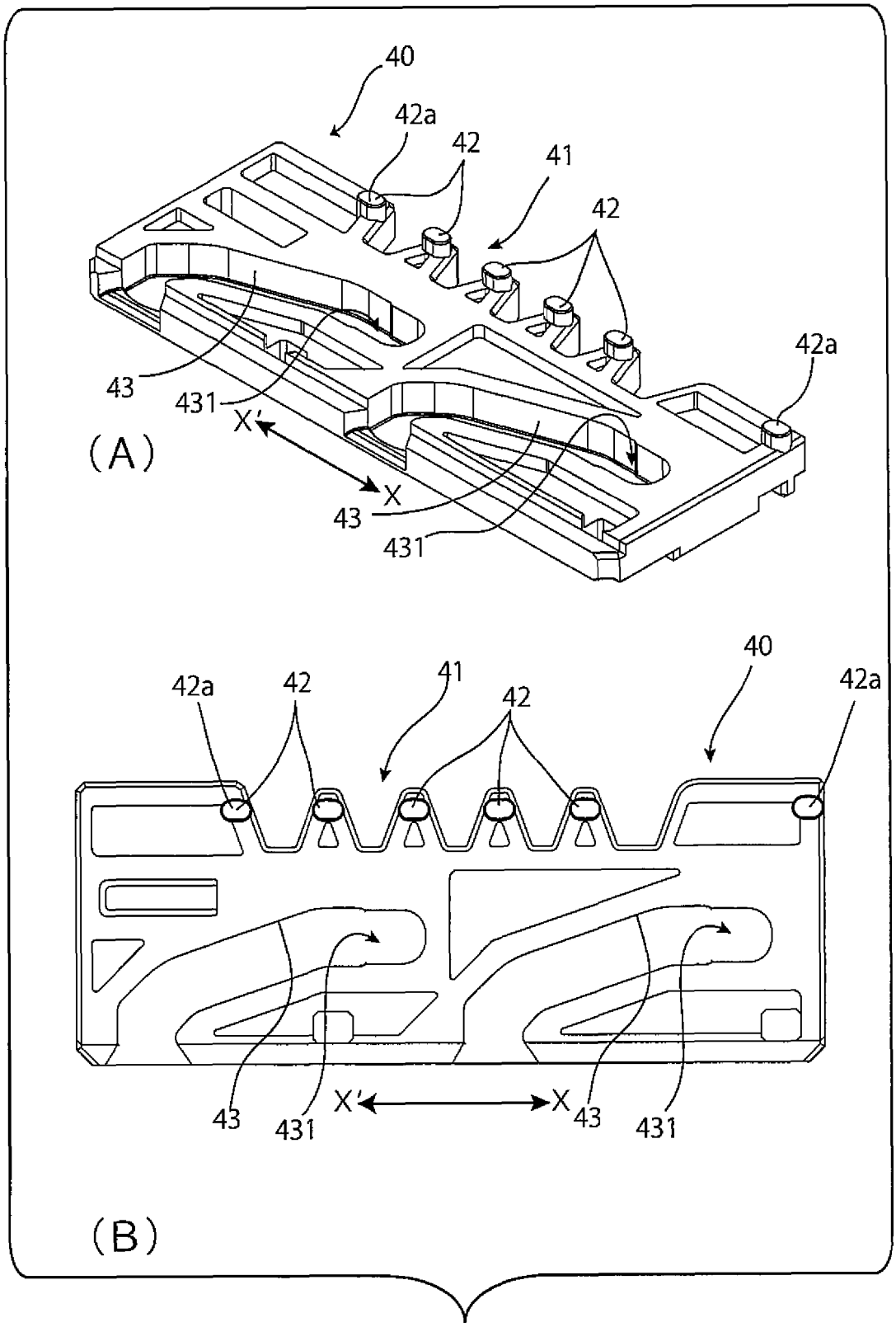
40
42a
42
41
42
42a
43
431
X'
X
(A)
43
431
42a
42
41
42
40
42a
43
431
X'
X
43
431
(B)

FIG.4

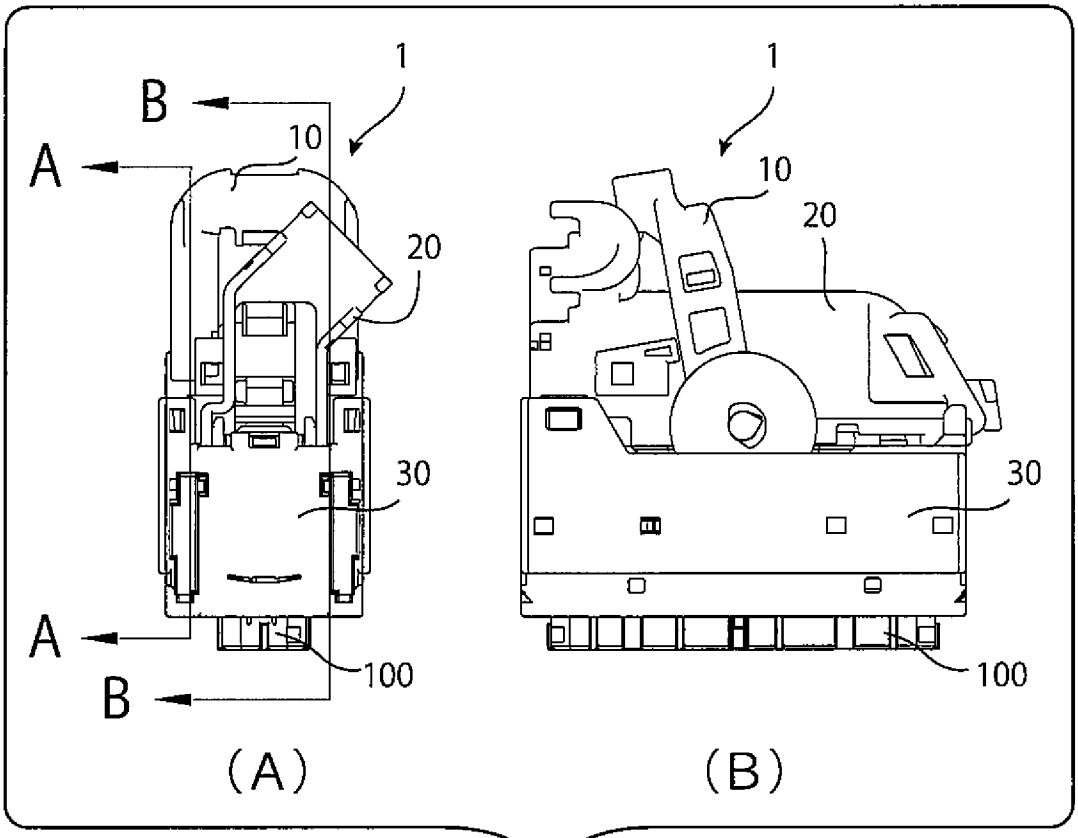

FIG.5

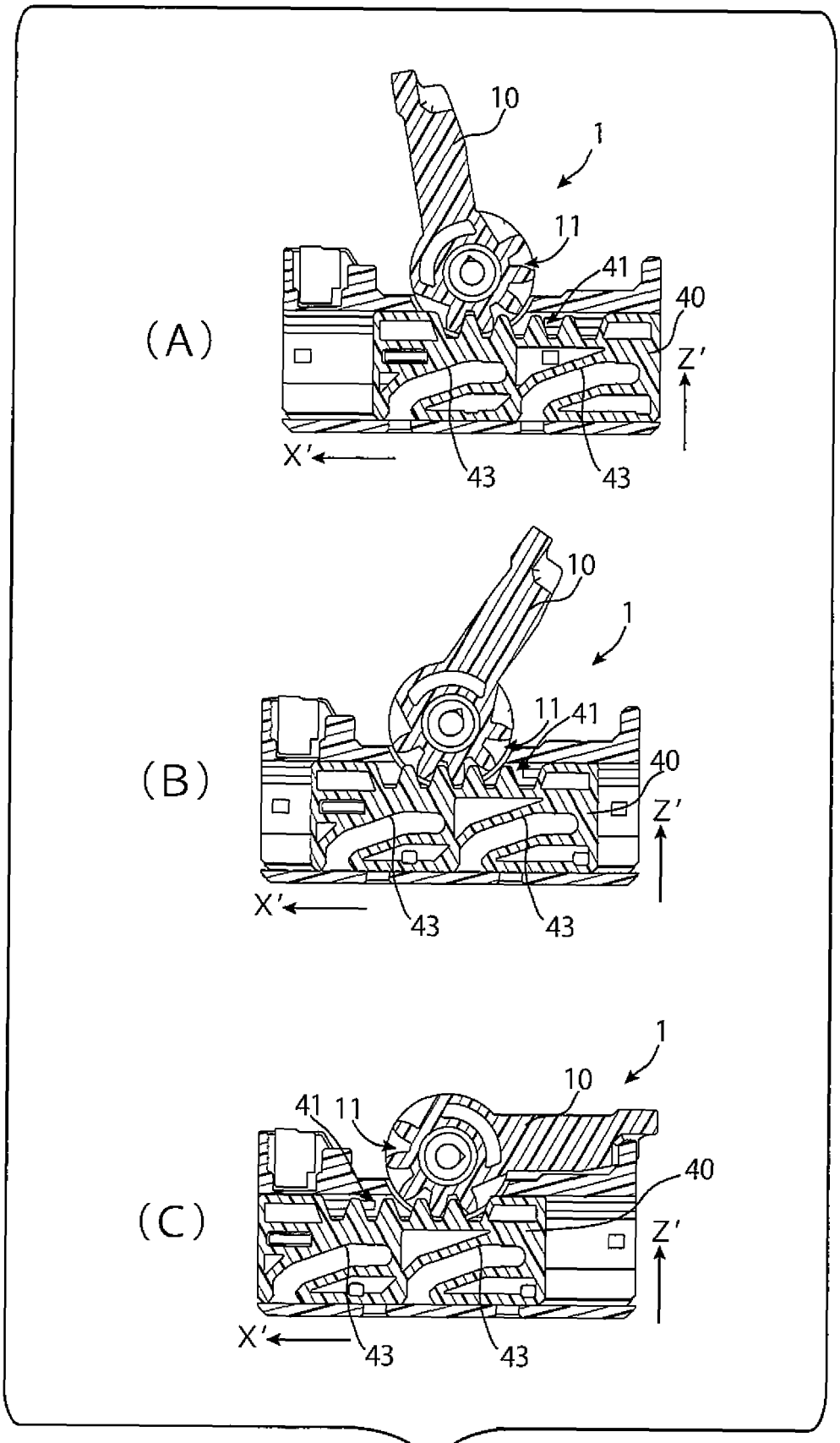

FIG.6

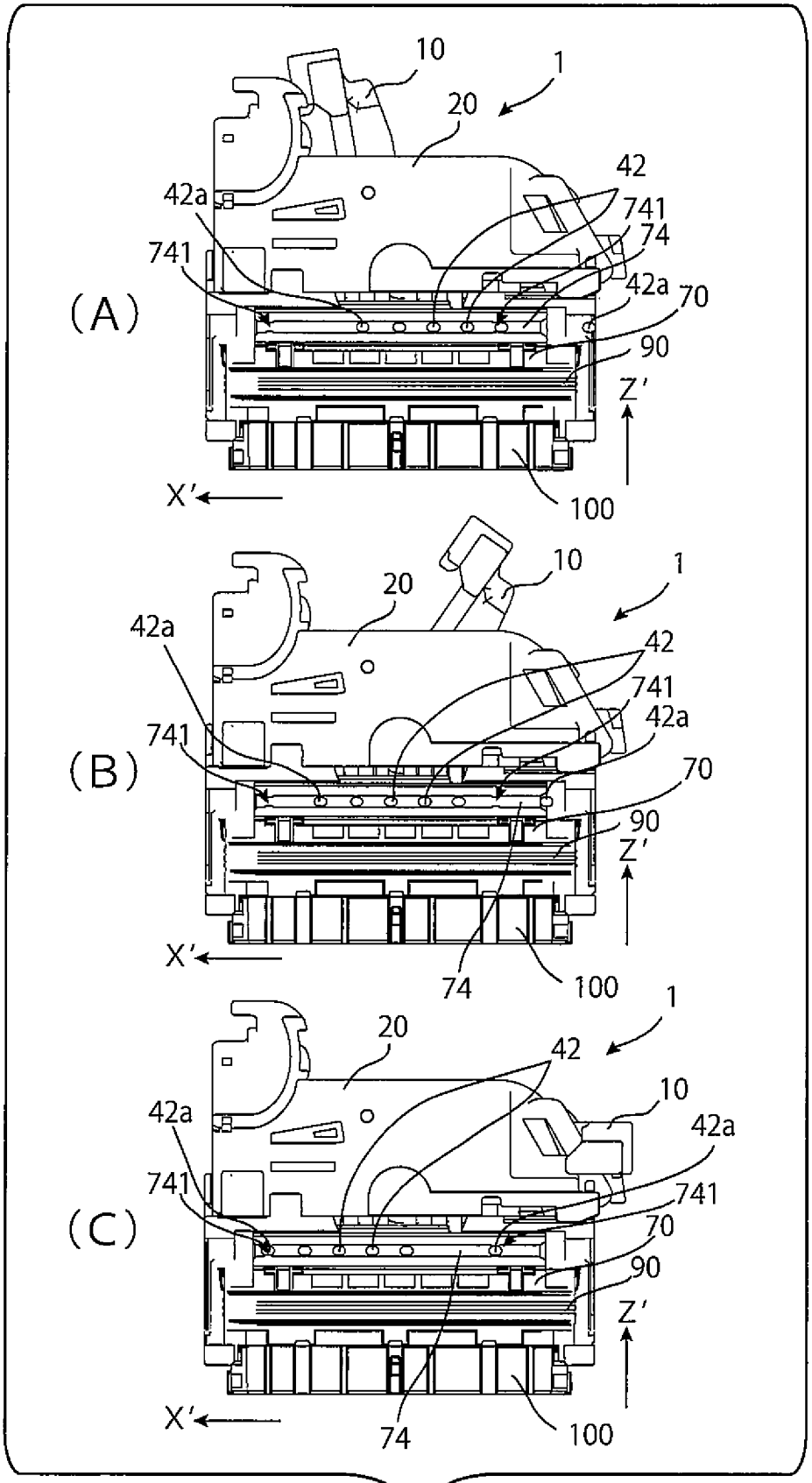
(A)
10
1
20
42
42a
741
74
741
42a
70
90
Z'
X'
100
(B)
10
1
20
42a
42
741
741
42a
70
90
Z'
X'
74
100
(C)
1
20
42
10
42a
42a
741
741
70
90
Z'
X'
74
100

FIG.7

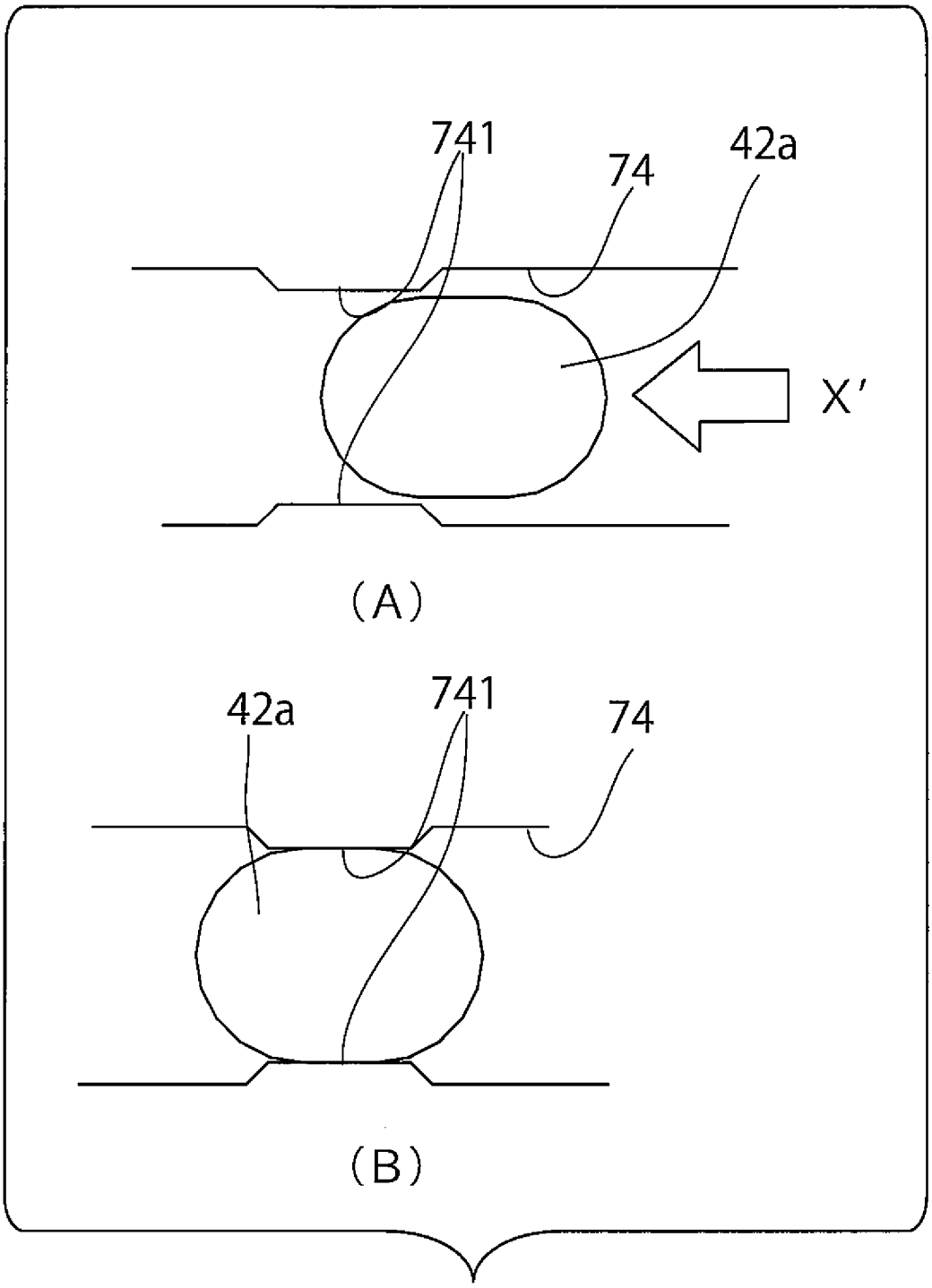

FIG.8

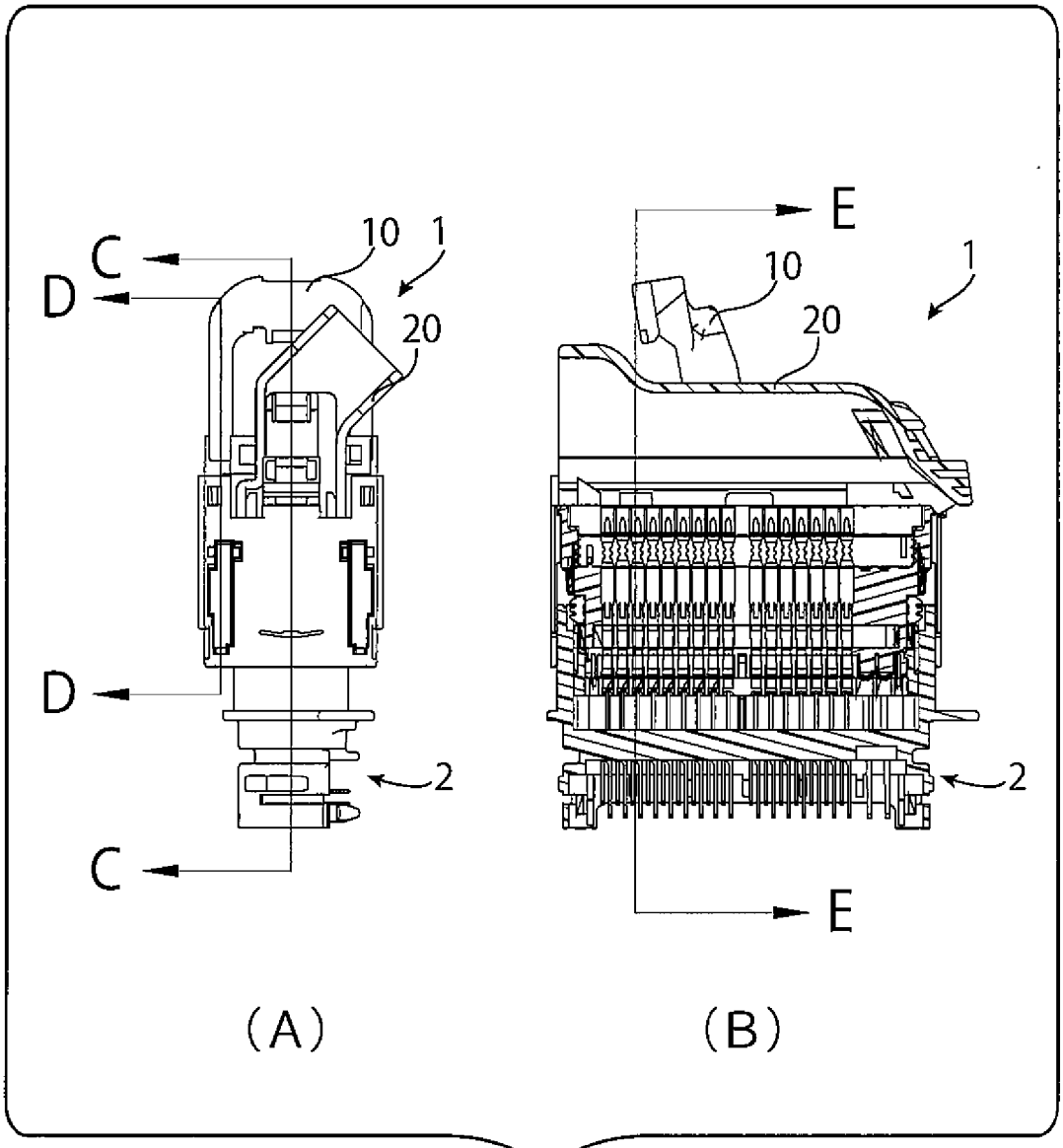

FIG.9

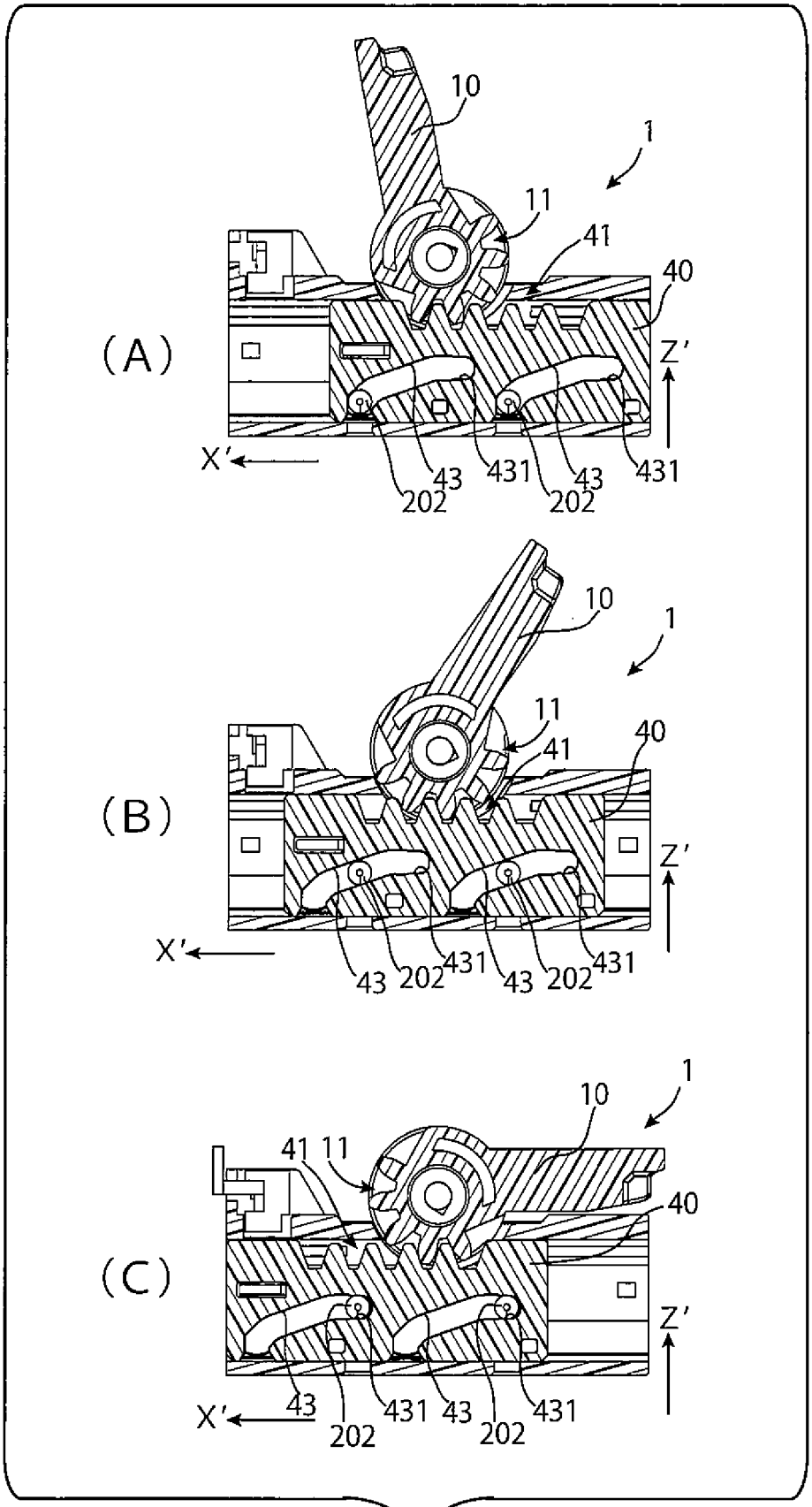

FIG.10

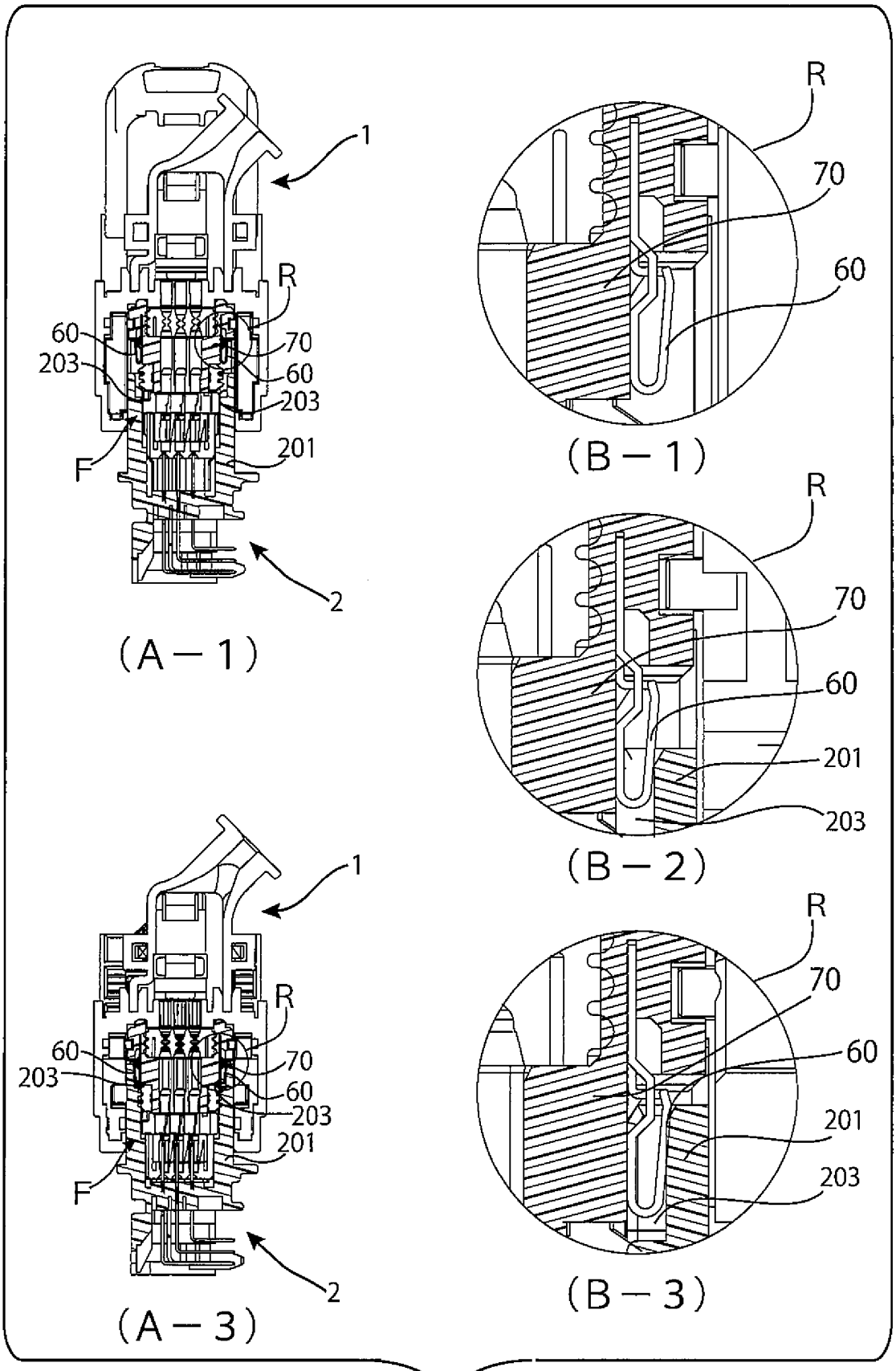
1
R
60
70
203
60
203
201
F
2
(A－1)
R
70
60
(B－1)
R
70
60
201
203
(B－2)
1
R
60
70
203
60
203
201
F
2
(A－3)
R
70
60
201
203
(B－3)

FIG.11

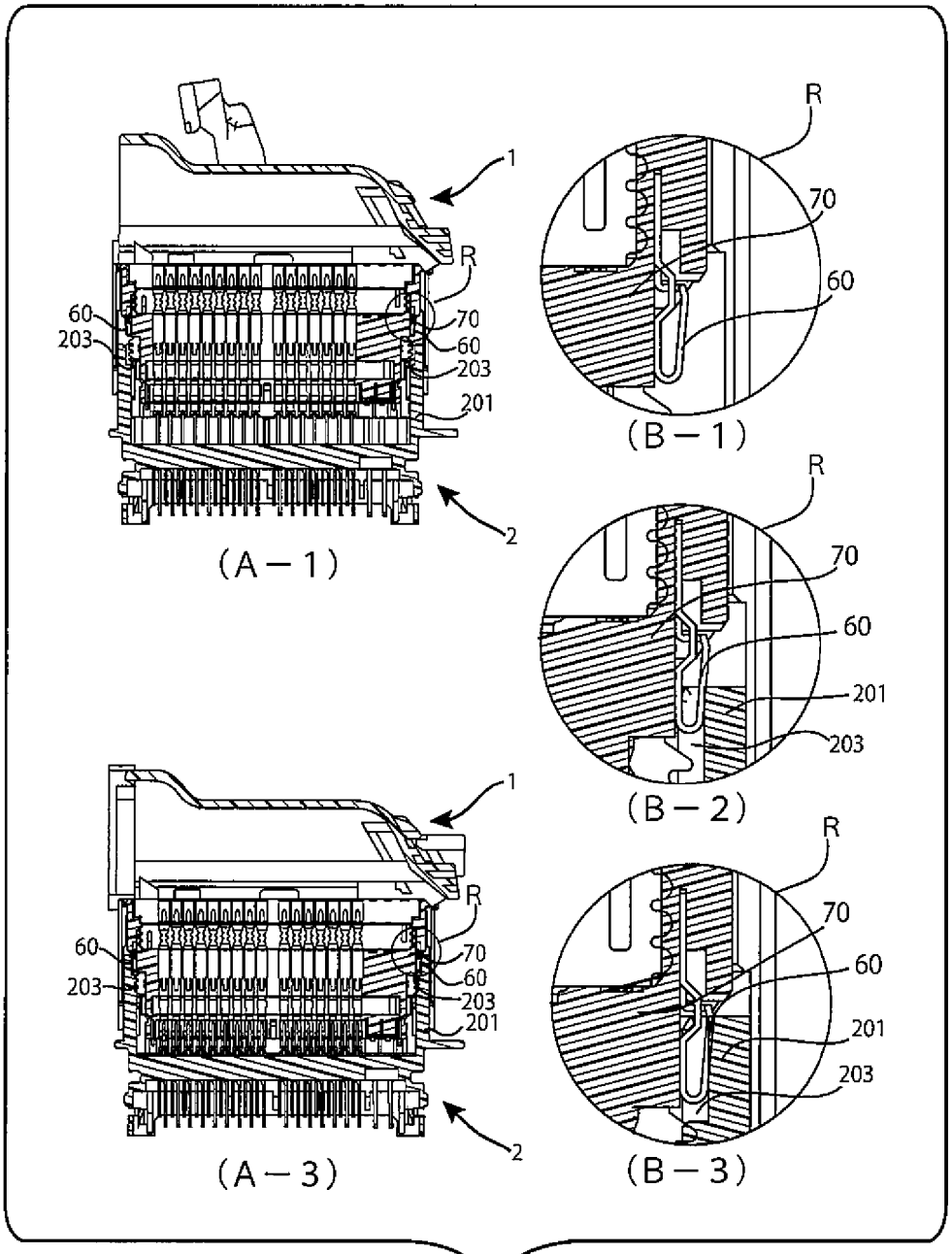
1
R
60
203
70
60
203
201
2
(A－1)
R
70
60
(B－1)
R
70
60
201
203
(B－2)
1
R
60
203
70
60
203
201
2
(A－3)
R
70
60
201
203
(B－3)

FIG.12

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- JP 2011023201 A **[0003] [0010] [0011]**
- US 20090325416 A **[0004]**
- US 20080102683 A **[0005]**
- US 20050221647 A **[0006]**
- US 20060040533 A **[0006]**
- US 3394337 A **[0007]**
- US 8092246 B **[0007]**
- US 7285005 B **[0008]**
- US 6347955 B **[0008]**
- JP 2009230898 B **[0009]**